

### **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application. Please amend Claim 40 as indicated in the Listing of Claims.

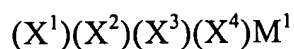
#### **Listing of Claims**

Claims 1-7. Cancelled.

8. (Previously Amended) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising contacting said catalyst composition and at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising contacting at least one organometal compound, at least one treated solid oxide compound, and at least one organoaluminum compound to produce said catalyst composition,

wherein said organometal compound has the following general formula



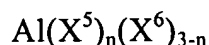
wherein  $M^1$  is selected from titanium, zirconium, or hafnium, and

wherein  $(X^1)$  is independently selected from cyclopentadienyls, indenyls, fluorenyls, substituted cyclopentadienyls, substituted indenyls, ~~and~~ or substituted fluorenyls, and

wherein substituents on said substituted cyclopentadienyls, substituted indenyls, and substituted fluorenyls are selected from aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, ~~and~~ organometallic groups, or hydrogen; and

wherein  $(X^3)$  and  $(X^4)$  are independently selected from halides, aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, or organometallic groups, and

wherein (X<sup>2</sup>) is selected from cyclopentadienyls, indenyls, fluorenyls, substituted cyclopentadienyls, substituted indenyls, substituted fluorenyls, halides, aliphatic groups, cyclic groups, combinations of aliphatic and cyclic groups, or organometallic groups, and wherein said organoaluminum compound has the following general formula,



wherein (X<sup>5</sup>) is a hydrocarbyl having from 1-20 carbon atoms, and wherein (X<sup>6</sup>) is a halide, hydride, or alkoxide, and wherein "n" is a number from 1 to 3 inclusive; wherein said treated solid oxide compound is produced by a process comprising contacting at least one solid oxide compound with at least one electron-withdrawing anion source compound; and wherein said solid oxide compound is calcined before, during, or after contacting said electron-withdrawing anion source; and wherein the activity of said catalyst composition is greater than 250 grams of polyethylene per gram of treated solid oxide compound per hour; and wherein there is a substantial absence of aluminoxanes and organoborates.

Claims 9 - 25. Cancelled.

26. (Previously Amended) A process according to Claim 8, wherein said polymerization conditions comprise slurry polymerization conditions.

27. (Previously Amended) A process according to Claim 26, wherein said contacting is conducted in a loop reactor zone.

28. (Previously Amended) A process according to Claim 27, wherein said contacting is conducted in the presence of a diluent that comprises, in major part, isobutane.

29. (Previously Amended) A process according to Claim 26, wherein said at least one monomer is ethylene.

30. (Previously Amended) A process according to Claim 26, wherein said at least one monomer comprises ethylene and an aliphatic 1-olefin having 3 to 20 carbon atoms per molecule.

31. (Previously Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising:

- 1) contacting said solid oxide compound with said at least one electron-withdrawing anion source compound to form a first mixture; and
- 2) calcining said first mixture to form said treated solid oxide compound.

32. (Previously Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising simultaneously calcining and contacting said solid oxide compound and said at least one electron-withdrawing anion source compound.

33. (Previously Amended) A process according to Claim 8, wherein said electron-withdrawing anion source compound is selected from sulfates, halides, or triflate.

34. (Previously Amended) A process according to Claim 8, wherein said calcining is conducted for about 1 hour to about 10 hours at a temperature in the range of about 400° C to about 800° C.

35. (Previously Amended) A process according to Claim 8, wherein said treated solid oxide compound is produced by a process comprising increasing the acidity of said solid oxide compound by two, or more, electron-withdrawing anion source compounds in two, or more, separate steps.

36. (Previously Amended) A process according to Claim 35, wherein said treated solid oxide compound is produced by a process comprising:

- 1) contacting said at least one solid oxide compound with a first electron-withdrawing anion source compound to form a first mixture;
- 2) calcining said first mixture to produce a calcined first mixture;
- 3) contacting said calcined first mixture with a second electron-withdrawing anion source compound to form a second mixture; and
- 4) calcining said second mixture to form said treated solid oxide compound.

37. (Previously Amended) A process according to Claim 8, wherein said catalyst composition is produced by a process comprising:

- 1) contacting said organometal compound and said treated solid oxide compound together for about 1 minute to about 1 hour at a temperature of about 25°C to about 100°C to form a first mixture; and
- 2) contacting said first mixture with an organoaluminum compound to form said catalyst composition.

38. (Previously Amended) A process according to Claim 8, wherein said catalyst composition can polymerize ethylene into a polymer with an activity greater than 2000 (gP/(gS·hr)), and

wherein said at least one organometal compound is selected from

bis(cyclopentadienyl) hafnium dichloride;  
bis(cyclopentadienyl) zirconium dichloride;  
[ethyl(indenyl)<sub>2</sub>] hafnium dichloride;  
[ethyl(indenyl)<sub>2</sub>] zirconium dichloride;  
[ethyl(tetrahydroindenyl)<sub>2</sub>] hafnium dichloride;  
[ethyl(tetrahydroindenyl)<sub>2</sub>] zirconium dichloride;  
bis(n-butylcyclopentadienyl) hafnium dichloride;  
bis(n-butylcyclopentadienyl) zirconium dichloride;  
((dimethyl)(diindenyl)silane) zirconium dichloride;  
((dimethyl)(diindenyl)silane) hafnium dichloride;  
((dimethyl)(ditetrahydroindenyl)silane) zirconium  
dichloride;  
((dimethyl)(di(2-methyl indenyl)) silane) zirconium  
dichloride;  
bis(fluorenyl) zirconium dichloride; or mixtures thereof,  
and

wherein said at least one organoaluminum compound is selected from

trimethylaluminum;  
triethylaluminum;  
tripropylaluminum;  
diethylaluminum ethoxide;  
tributylaluminum;  
triisobutylaluminum hydride;  
triisobutylaluminum;

diethylaluminum chloride; or mixtures thereof, and  
wherein said solid oxide compound is selected from  $\text{Al}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{BeO}$ ,  $\text{Bi}_2\text{O}_3$ ,  
 $\text{CdO}$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{CuO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{Ga}_2\text{O}_3$ ,  $\text{La}_2\text{O}_3$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{MoO}_3$ ,  $\text{NiO}$ ,  $\text{P}_2\text{O}_5$ ,  
 $\text{Sb}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{SnO}_2$ ,  $\text{SrO}$ ,  $\text{ThO}_2$ ,  $\text{TiO}_2$ ,  $\text{V}_2\text{O}_5$ ,  $\text{WO}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{ZrO}_2$ ; and  
mixed oxides thereof, or mixtures thereof, and  
wherein said treated solid oxide compound has been contacted with fluoride or  
chloride or both.

39. (Previously Amended) A process of using a catalyst composition to  
polymerize at least one monomer to produce a polymer, said process comprising  
contacting said catalyst composition and said at least one monomer in a  
polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining alumina at about  $600^\circ\text{C}$  for about 3 hours and  
simultaneously contacting with carbon tetrachloride to produce  
a treated solid oxide compound;
- 2) combining said treated solid oxide compound with bis(n-  
butylcyclopentadienyl) zirconium chloride at a temperature in  
a range of about  $25^\circ\text{C}$  to about  $100^\circ\text{C}$  to produce a mixture;  
and
- 3) about between 1 minute and 1 hour, combining said mixture  
and triethylaluminum to produce said catalyst composition.

40. (Currently Amended) A process of using a catalyst composition to  
polymerize at least one monomer to produce a polymer, said process comprising  
contacting said catalyst composition and said at least one monomer in a  
polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining an oxide selected from alumina, silica-alumina, aluminophosphate, and mixtures thereof to produce a calcined oxide;
- 2) contacting said calcined oxide with a treating agent selected from sulfating agents, fluoriding agents, and chloriding agents to produce a treated oxide;
- 3) combining (1) said treated oxide, (2) an organoaluminum compound selected from triethylaluminum, triisobutylaluminum, and mixtures thereof; and (3) an organometal compound,

wherein said catalyst composition has an activity greater than 100 gP/gS·hr in the substantial absence of aluminoxanes and organoborates.

41. (Previously Amended) A process according to Claim 40, wherein said organometal compound is bis(n-butylcyclopentadienyl) zirconium dichloride.

42. (Previously Amended) A process according to Claim 41, wherein said treating agent is a chloriding agent.

43. (Previously Amended) A process according to Claim 42, wherein said treating agent is carbon tetrachloride.

44. (Previously Added) A process of using a catalyst composition to polymerize at least one monomer to produce a polymer, said process comprising contacting said catalyst composition and said at least one monomer in a polymerization zone under polymerization conditions to produce said polymer;

wherein said catalyst composition is produced by a process comprising:

- 1) calcining alumina to produce a calcined alumina;
- 2) treating said calcined alumina with carbon tetrachloride at an elevated temperature to give a treated alumina;
- 3) combining said treated alumina with triethylaluminum and bis(n-butylcyclopentadienyl) zirconium dichloride.

45. (Previously Amended) A process according to Claim 8, wherein said catalyst composition is produced by a process consisting essentially of contacting said organometal compound, said treated solid oxide compound, and said organoaluminum compound.

Claims 46-49. Cancelled.

50. (Previously Added) A process according to Claim 8, wherein said at least one organometal compound is selected from:

bis(cyclopentadienyl) hafnium dichloride;  
bis(cyclopentadienyl) zirconium dichloride;  
[ethyl(indenyl)<sub>2</sub>] hafnium dichloride;  
[ethyl(indenyl)<sub>2</sub>] zirconium dichloride;  
[ethyl(tetrahydroindenyl)<sub>2</sub>] hafnium dichloride;  
[ethyl(tetrahydroindenyl)<sub>2</sub>] zirconium dichloride;  
bis(n-butylcyclopentadienyl) hafnium dichloride;  
bis(n-butylcyclopentadienyl) zirconium dichloride;  
((dimethyl)(diindenyl)silane) zirconium dichloride;  
((dimethyl)(diindenyl)silane) hafnium dichloride;  
((dimethyl)(ditetrahydroindenyl)silane) zirconium  
dichloride;



((dimethyl)(di(2-methyl indenyl)) silane) zirconium  
dichloride;  
bis(fluorenyl) zirconium dichloride; or mixtures thereof.

51. (Previously Added) A process according to Claim 8, wherein said at least one organoaluminum compound is selected from trimethylaluminum, triethylaluminum, tripropylaluminum, diethylaluminum ethoxide, tributylaluminum, triisobutylaluminum hydride, triisobutylaluminum, diethylaluminum chloride, or mixtures thereof.

52. (Previously Added) A process according to Claim 8, wherein said at least one solid oxide compound is selected from  $\text{Al}_2\text{O}_3$ ,  $\text{B}_2\text{O}_3$ ,  $\text{BeO}$ ,  $\text{Bi}_2\text{O}_3$ ,  $\text{CdO}$ ,  $\text{Co}_3\text{O}_4$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{CuO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{Ga}_2\text{O}_3$ ,  $\text{La}_2\text{O}_3$ ,  $\text{Mn}_2\text{O}_3$ ,  $\text{MoO}_3$ ,  $\text{NiO}$ ,  $\text{P}_2\text{O}_5$ ,  $\text{Sb}_2\text{O}_5$ ,  $\text{SiO}_2$ ,  $\text{SnO}_2$ ,  $\text{SrO}$ ,  $\text{ThO}_2$ ,  $\text{TiO}_2$ ,  $\text{V}_2\text{O}_5$ ,  $\text{WO}_3$ ,  $\text{Y}_2\text{O}_3$ ,  $\text{ZnO}$ ,  $\text{ZrO}_2$ , mixed oxides thereof, or mixtures thereof.

53. (Previously Added) A process according to Claim 52, wherein said at least one solid oxide compound is selected from silica-alumina or silica-zirconia.

54. (Previously Added) A process according to Claim 38, wherein said at least one solid oxide compound is selected from silica-alumina or silica-zirconia.